



2020 Population Health Report

Certificate of Public Advantage, Population Health Sub-Index
Measures for Ballad Health

Tennessee Department of Health | COPA Report | February 2021



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Population Health Sub-Index

Introduction

Population health is commonly defined as the health outcomes of a specific group of people and the distribution of such outcomes within the group.¹ The focus of the Population Health Sub-Index and this Certificate of Public Advantage (COPA) Population Health Report is the health of the population residing in Ballad's Tennessee Geographic Service Area (TN GSA). The following 10 counties comprise the TN GSA: Carter, Cocke, Greene, Hamblen, Hancock, Hawkins, Johnson, Sullivan, Unicoi, and Washington.

Ballad serves a larger geographic service area (GSA) in the Appalachian Region and includes the 10 Northeast Tennessee counties listed above as well as 11 counties and two independent cities in Southwest Virginia. This region has a number of health, economic, and geographical issues, which when combined present a unique and challenging environment for the improvement of the quality and access of health care and health outcomes in the region. These unique challenges were reaffirmed in a recent report issued by the Appalachian Regional Commission, Robert Wood Johnson Foundation and the Foundation for a Healthy Kentucky (*Health Disparities in Appalachia*), which found that the performance in the Appalachian Region is worse than the performance in the United States as a whole in seven of the 10 leading causes of death: heart disease, cancer, chronic obstructive pulmonary disease, injury, stroke, diabetes, and suicide. Additionally, the study found the "years of potential life lost," a measure of premature mortality, is 25 percent higher in the Appalachian Region than in the nation as a whole.

This merger provides a unique opportunity to improve population health for the people in Ballad Health's GSA. Ballad expects the merger to generate substantial savings by reducing duplication of services and improving efficiencies within its system and is committed to reinvesting a portion of that savings, \$75 Million over ten years, to improve the overall health of the population. Confirming that these investments are made and monitoring population health changes in the area are functions of the state's active supervision role. This Population Health Sub-Index serves to objectively track population health changes and evaluate the achievement of population health improvement.

¹ Kindig, D. and G. Stoddart. 2003. What is population health? *American Journal of Public Health* 93(3):380-383 <http://ajph.aphapublications.org/doi/abs/10.2105/AJPH.93.3.380>

Population Health Sub-Index Design

The purpose of this Population Health Sub-Index is to measure and evaluate the progress of various population health outcomes in Ballad Health's TN GSA, also referred to as the TN COPA Region. The first report, published in March 2019 and updated November 2019 established the baseline values for the Population Health Sub-Index measures by reporting data available in 2018. This 2020 Population Health Report focuses on the Certificate of Public Advantage Population Health Sub-Index measures for Ballad Health and provides updated values that the Tennessee Department of Health (TDH) will use to track ongoing changes in the health of residents of the TN COPA Region.

The clear and convincing public advantage of the Cooperative Agreement will be demonstrated by comparing the rate of change in a population health priority measure in the TN COPA Region post-merger to the rate of change prior to the merger. The measures' rates of change in Ballad's TN GSA will also be compared to three comparison geographies: 1) TN Peer Counties; 2) the state of Tennessee; and 3) the United States.

The design of the Population Health Sub-Index is a blend of the State Health Plan² objectives, TDH's Vital Signs work³, the National Academy of Medicine's population health efforts⁴, the models of health used in United Health Foundation's America's Health Rankings⁵ (AHR), and the Robert Wood Johnson Foundation's County Health Rankings⁶ (CHR). AHR has been published since 1990 and CHR since 2010; both are widely recognized as providing fair assessments of the overall health of a population.

Comparison Geographies

In order to show that changes in health outcomes are likely a result of the merger, and not a result of other external factors, it is critical to compare the changes in health outcomes in the TN

² State of Tennessee, 2015 Edition of the State Health Plan, Division of Health Planning, Tennessee Department of Health, 2015

³ Tennessee's Vital Signs are a set of metrics meant to measure the pulse of Tennessee's population health. Inspired by the National Academies of Medicine's Vital Signs, TDH began a process in 2015 of identifying Tennessee-specific metrics to measure health and progress at the state level. Through an extensive state-wide public engagement process, 12 metrics were ultimately selected to provide an at-a-glance view of Tennessee's leading indicators of health and prosperity.

⁴ National Academies of Sciences, Engineering, and Medicine. 2016. Metrics that matter for population health action: Workshop summary. Washington, DC: The National Academies Press. doi: 10.17226/21899.

⁵ United Health Foundation. America's Health Rankings. <https://www.americashealthrankings.org>

⁶ University of Wisconsin Population Health Institute. County Health Rankings & Roadmaps. www.countyhealthrankings.org.

COPA Region to those in other geographies. Controlling for external factors affecting health outcomes can best be achieved with a comparison region consisting of counties whose characteristics are similar to those of the TN COPA Region.

TDH selected 12 Tennessee counties to serve together as a comparison region, based on their similarities in income, age distribution, educational attainment, population density, and geographic proximity to the TN COPA Region. The Tennessee Peer Counties are: Anderson, Cannon, Claiborne, Cumberland, Jefferson, McMinn, Marion, Monroe, Putnam, Roane, Sevier, and White. The methods used in selecting the Tennessee Peer Counties can be found in the Population Health Report Appendix 4.

Population Health Sub-Index Scoring

Because Population Health is linked to health behaviors and social circumstances affecting groups of people, change in these measures will take time to achieve. For this reason, the first few scoring years are based on achievement of process measures, as listed in Ballad Health's Population Health Plan, and investments made in population health improvement (An outline of the Population Health Sub-Index scoring for each of the first ten years of the COPA can be found in this report's Population Health Appendix as well as in Exhibit D of the [Terms of Certification](#)).

Fifty-six population health measures were selected by TDH and determined important for objectively tracking the impact of the COPA on Population Health. Twenty-five of those measures comprise the Population Health Sub-Index Score. The 25 Priority Population Health Measures have been identified by the department as being closely related to the department's health planning goals set out in the State Health Plan. Ballad Health will be evaluated on improvement in these 25 measures. They are identified in Table 1 below with an asterisk ("*"). The remaining 31 measures are considered the Population Health Monitoring Measures and will be tracked by TDH for monitoring purposes only.

2020 Population Health Data Table – for Year 2

TABLE 1

		TN COPA Value	TN Peer Counties Value	TN Value	US Value
BIG FOUR / Behaviors					
Tobacco Use		COPA	PEER	TN	US
1*	Smoking (<i>% of adults</i>)	23.5%	26.3%	19.9%	15.3%
2	Smoking in higher density counties (<i>% of adults</i>)	n/a	n/a	n/a	n/a
3	Smoking in lower density counties (<i>% of adults</i>)	n/a	n/a	n/a	n/a
4	Smoking among those with less than a high school education (<i>% of adults</i>)	n/a	n/a	36.9%	25.5%
5	Smoking among those with a high school education or more (<i>%</i>)	21.5%	23.9%	17.3%	13.9%
6*	Mothers who smoke during pregnancy (<i>% of live births</i>)	21.3%	19.7%	11.5%	6.5%
7*	Youth tobacco use (<i>% of high school students</i>)	11.2%	10.4%	7.1%	6.0%
8	Youth -ever tried cigarette smoking (<i>% of high school students</i>)	26.4%	26.4%	29.2%	24.1%
9	Youth electronic vapor product use (<i>% of high school students</i>)	24.5%	20.9%	22.1%	32.7%
Physical Activity		COPA	PEER	TN	US
10*	Physically active adults (<i>% of adults</i>)	64.9%	69.6%	69.9%	74.0%
11*	Physically active students (<i>% of high school students</i>)	84.3%	84.1%	81.9%	83.0%
Obesity		COPA	PEER	TN	US
12	Obesity (<i>% of adults</i>)	37.1%	37.4%	36.5%	31.3%
13	Obesity in higher density counties (<i>% of adults</i>)	n/a	n/a	n/a	n/a
14	Obesity in lower density counties (<i>% of adults</i>)	n/a	n/a	n/a	n/a
15	Obesity among those with less than a high school education (<i>% of adults</i>)	n/a	n/a	33.8%	36.2%
16	Obesity among those with a high school education or more (<i>% of adults</i>)	35.6%	39.1%	36.9%	30.7%
17*	Obesity counseling and education (<i>% of physician office visits</i>)	<i>New</i>	<i>n/a</i>	<i>n/a</i>	<i>n/a</i>
18*	Overweight and obesity among TN public school students (<i>% of students in grades kindergarten, 2, 4, 6, 8, and one year of high school</i>)	42.6%	42.1%	39.5%	<i>n/a</i>
Breastfeeding Measures		COPA	PEER	TN	US
19*	Average mPINC (Maternal Practices in Infant Nutrition and Care) score	78	<i>n/a</i>	72	79
20*	Breastfeeding initiation (<i>% of live births</i>)	74.6%	75.9%	80.2%	84.1%
21*	Infants breastfed at six (6) months (<i>% of 6-month olds</i>)	<i>New</i>	<i>New</i>	27.2%	25.6%
High School Student Healthy Eating		COPA	PEER	TN	US
22	Fruit consumption among high school students (<i>% of high school students</i>)	84.6%	86.4%	88.9%	93.7%
23	Vegetable consumption among high school students (<i>% of high school students</i>)	85.0%	88.2%	89.0%	92.1%
24	Soda consumption among high school students (<i>% high school students</i>)	74.9%	82.6%	76.1%	68.3%
Substance Abuse		COPA	PEER	TN	US
25*	NAS (Neonatal Abstinence Syndrome) births (<i>cases per 1,000 live births</i>)	34.3	17.8	10.0	<i>n/a</i>
26*	Drug deaths (<i>deaths per 100,000 population</i>)	21.9	29.8	30.6	21.7
27	Drug overdoses (<i>non-fatal overdoses per 100,000 population</i>)	320.3	384.18	348.08	<i>n/a</i>

28	Painkiller prescriptions (prescriptions <i>per 1,000 population</i>)	1022.8	994.3	786.2	514
29	Prescription drugs among high school students (% of high school students using prescription pain relievers not prescribed by the doctor)	12.8%	11.8%	13.7%	14.3%
30*	MME for Pain (Total morphine milligram equivalents (MME) opioids for pain per capita)	893.7	873.4	621.3	424.6
IMMUNIZATIONS		COPA	PEER	TN	US
31*	On-time vaccinations – children (% of children that are up-to-date on immunizations at the time of kindergarten entry).	95.7%	95.0%	94.8%	n/a
32*	Ballad Entity participation in TennIIS (% of active Ballad entities in Tennessee)	83%	n/a	n/a	n/a
33	Entity participation in TennIIS (# of active TennIIS entities)	345	284	2901	n/a
34	Vaccinations – HPV Females (# of HPV shots administered for females aged 11 to 17 years, either quadrivalent or bivalent)	7,584	5,796	65,768	n/a
35	Vaccinations – HPV Males (# of HPV shots administered for males aged 11 to 17 years, either quadrivalent or bivalent)	7,532	8,835	66,364	n/a
36*	Vaccinations – Tdap (# of Tdap shots administered for patients aged 11 to 17 years)	9,160	7,817	85,063	n/a
37*	Vaccination - Flu, Older Adults (% Medicare beneficiaries aged 65+)	66.5	58.6	63.7%	63.8%
38	Vaccinations - Flu, Adults (% of adults)	46.0%	37.9%	41.2%	42.9%
COMMUNITY / ENVIRONMENT		COPA	PEER	TN	US
39*	Teen births (births <i>per 1,000 females aged 15-19 years</i>)	24.4	26.8	23.7	17.4
Third Grade Reading		COPA	PEER	TN	US
40*	Third grade reading level (% of 3rd graders who score “on-track” or “mastered” on TNReady reading assessment)	39.3%	33.4%	36.7%	n/a
41	Third grade reading level - Higher density counties (% of students)	42.8%	33.5%	n/a	n/a
42	Third grade reading level - Lower density counties (% of students)	34.4%	33.3%	n/a	n/a
Oral Health		COPA	PEER	TN	US
43	Fluoridated water (% of population on community water systems receiving fluoridated water)	91.9%	93.4%	88.8%	73.0%
44*	Dental sealants – children (% Medicaid enrollees aged 6–9 years)	11.1%	11.0%	12.6%	n/a
45	Dental sealants - adolescents (% Medicaid enrollees aged 13-15 years)	5.6%	5.9%	7.9%	n/a
OUTCOMES		COPA	PEER	TN	US
46*	Frequent mental distress (% of adults)	20.4%	18.1%	15.8%	13.6%
47	Frequent physical distress (% of adults)	22.1%	17.5%	15.1%	12.5%
48*	Infant mortality (deaths per 1,000 live births)	8.4	5.5	7.0	5.7
49*	Low birthweight (% of live births)	8.9%	8.5%	9.2%	8.3%
50	Child mortality (deaths per 100,000 population for children aged 1-19 years)	29.9	38.8	32.2	50.2
51	Cardiovascular deaths (deaths per 100,000 population)	340.1	300.6	246.2	264.0
52	Cancer deaths (deaths per 100,000 population)	278.4	256.7	210.6	183.2
53	Diabetes deaths (deaths per 100,000 population)	36.2	45.1	31.6	26.0
54*	Diabetes adverse events (% of adults identified with prediabetes who are referred to a qualifying diabetes prevention program)	New	n/a	n/a	n/a
55	Suicide deaths (deaths per 100,000 population)	25	22.3	17.9	14.8
56*	Premature death ratio (ratio of years lost before age 75 per 100,000 population for higher to lower density counties)	0.797	0.851	n/a	n/a

* These measures are the Priority Population Health Measures. The Population Health Sub-Index score for years 4-10 will be calculated based on the changes tracked on these 25 measures.

New – Data are not yet collected at this level, but they are expected for future reports.

n/a – Data are not available for comparison.

The most recent calendar, fiscal year, seasonal, or school year data available as of December 2020 were used for this report.

General notes regarding missing data in this report:

- Ballad Health is responsible for data collection of the following measures: Physician Office Visits that include counseling or education related to weight and physical activity (measure #17), Infants Breastfed at 6 months (measure #21), and Diabetes Adverse Events (measure # 54). Despite lengthy conversations between TDH and Ballad Health regarding these metrics and technical definitions, data have not yet been collected or analyzed for inclusion in this 2020 report.

Appendix 1:

Background

A **Certificate of Public Advantage (COPA)** is the written approval by the Tennessee Department of Health (TDH) that governs a Cooperative Agreement (a merger) among two or more hospitals. A COPA provides state action immunity to the hospitals from state and federal antitrust laws by **replacing competition with state regulation and Active Supervision**. The goal of the COPA process is to protect the interests of the public in the region affected and the State.

TDH has the authority to issue a COPA if applicants pursuing a COPA demonstrate that the **likely benefits** of the proposed Cooperative Agreement **outweigh the likely disadvantages** that would result from the loss of competition. The ability to grant a COPA is authorized by Tennessee's Hospital Cooperation Act of 1993, amended in 2015. Permanent Rules [1200-38-01](#) implement T.C.A. § 68-11-1301 – 68-11-1309.

In 2016, Mountain States Health Alliance and Wellmont Health System filed an application with TDH to form a Cooperative Agreement. Together they had a combined market share of over 75 percent in a geographic service area that spans 10 counties in northeast Tennessee and 11 counties in southwest Virginia (covering a total square mile area equal to the size of New Jersey) and **impacting a population of nearly 960,000 residents** (roughly equivalent to the population of Montana). These two systems applied to the state to sanction the largest COPA-governed merger in the country to date.

On January 31, 2018, after a lengthy and robust application review process, the Tennessee Department of Health, in coordination with the Tennessee Office of the Attorney General and Reporter, issued a Certificate of Public Advantage to Mountain States Health Alliance and Wellmont Health System, allowing them to merge under the name Ballad Health.

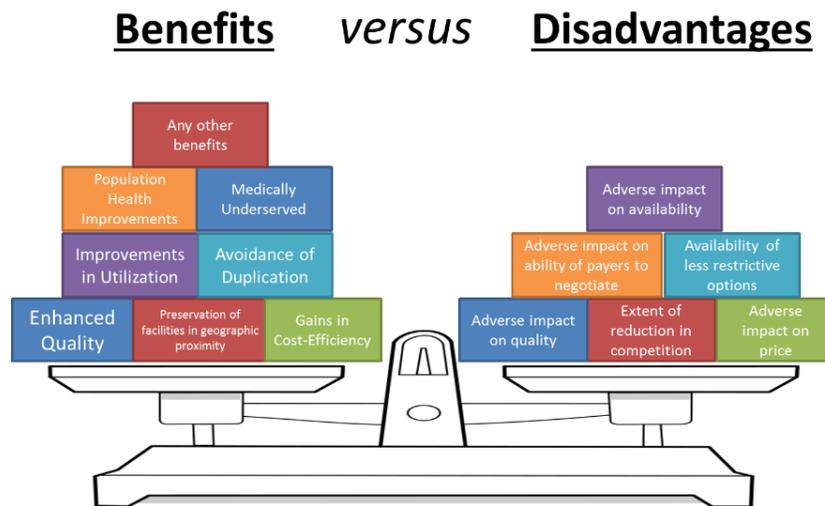
Links to supporting documents:

- [Executed Letter of Approval](#)
- [Amended and Restated Terms of Certification, dated July 31, 2019. \(Terms of Certification, dated January 31, 2018\)](#)
- [Certificate of Public Advantage](#)

Appendix 2:

Assessing Ongoing Public Advantage

TDH worked with the applicants and the Attorney General’s Office to create an **index** that would be used to determine if the **disadvantages** caused by a reduction in competition of health care and related services continue to be outweighed by clear and convincing evidence of **benefits** of the Cooperative Agreement.



Sub-Indices

The COPA Index consists of four categories of measures or sub-Indices that correspond to the potential benefits and disadvantages of the affiliation for which the COPA was issued:

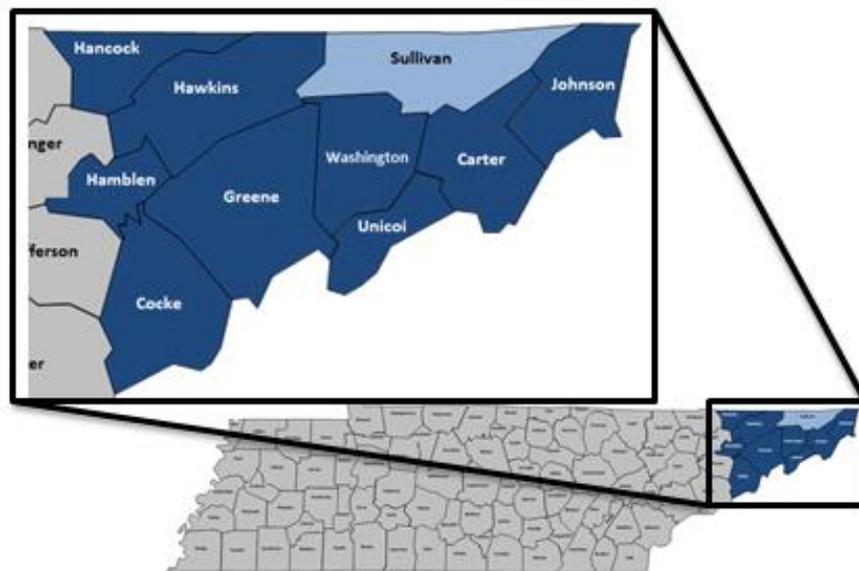
- Population Health Sub-Index – consisting of measures to track improvements in population health;
- Access Sub-Index – consisting of measures to track increased access to health care and prevention services;
- Economic Sub-Index – consisting of measures to verify a minimization of economic disadvantages resulting from a reduction in competition or degree of compliance with the Terms of Certification; and

- Other Sub-Index – consisting of other benefits, such as enhancement of quality of care, patient satisfaction, medical research, and education.

Annual Review

Pursuant to the COPA Rules 1200-38-01-.03 and the Terms of Certification, as part of its exercise of active supervision, TDH will annually use an Index to track the demonstration of ongoing public advantage. The annual review will include: 1) the determination of a final score and pass/fail grade, 2) Ballad's degree of compliance with the Terms of Certification, 3) trends of Ballad's performance subsequent to the issue date, and 4) other factors relevant to TDH's determination of the likely benefits and disadvantages of the affiliation.

Data reported in the Population Health, Access to Health Services and Other Report(s) as well as Ballad's Annual Report and other sources as deemed appropriate will be used to calculate the Population Health, Access, and Other Sub-Index scores.



The 10 counties highlighted above comprise the Tennessee Geographic Service Area for Ballad Health.

Appendix 3:

Population Health Sub-Index Data Source Table

TABLE 2

	Measure Definition	TN Data Source	US Data Source
BIG FOUR (BEHAVIORS)			
Tobacco Use			
1*	Smoking (<i>Percentage of adults who are self-reported smokers (smoked at least 100 cigarettes in their lifetime and currently smoke).</i>)	Tennessee Behavioral Risk Factor Surveillance System (BRFSS). Tennessee Department of Health (TDH), Office of Population Health Surveillance, 2019	Centers for Disease Control (CDC), Behavioral Risk Factor Surveillance System (BRFSS), 2019
2	Smoking in higher density counties (<i>TN COPA Value: Percentage of adults in Hamblen, Sullivan, and Washington counties who are self-reported smokers (smoked at least 100 cigarettes in their lifetime and currently smoke); TN & US Values: Not stratified by population density.</i>)	Tennessee BRFSS. TDH, Office of Population Health Surveillance, 2019	n/a
3	Smoking in lower density counties (<i>TN COPA Value: Percentage of adults in Carter, Cocke, Greene, Hancock, Hawkins, Johnson, and Unicoi counties who are self-reported smokers (smoked at least 100 cigarettes in their lifetime and currently smoke); TN & US Values: Not stratified by population density.</i>)	Tennessee BRFSS. TDH, Office of Population Health Surveillance, 2019	n/a
4	Smoking among those with less than a high school education (<i>Percentage of adults with less than a high school education who are self-reported smokers (smoked at least 100 cigarettes in their lifetime and currently smoke).</i>)	Tennessee BRFSS. TDH, Office of Population Health Surveillance, 2019	CDC, BRFSS, 2019
5	Smoking among those with a high school education or more (<i>Percentage of adults with high school education or more who are self-reported smokers (smoked at least 100 cigarettes in their lifetime and currently smoke).</i>)	Tennessee BRFSS. TDH, Office of Population Health Surveillance, 2019	n/a
6*	Mothers who smoke during pregnancy (<i>Percentage of mothers with live birth who report smoking during pregnancy.</i>)	TDH, Division of Vital Records and Statistics, Office of Vital Statistics, Birth Statistical Data System, 2019	CDC WONDER, 2018
7*	Youth tobacco use (<i>Percentage of high school students who self-reported having smoked cigarettes during the 30 days before the survey.</i>)	Tennessee Department of Education (TDOE), Office of Coordinated School Health, Youth Wellness Survey, 2019 / YRBS 2019	CDC, Youth Risk Behavior Survey (YRBS), 2019
8	Youth ever tried cigarette smoking (<i>Percentage of high school students who self-reported ever trying cigarette smoking, even one or two puffs.</i>)	TDOE, Office of Coordinated School Health, Youth Wellness Survey, 2019 / YRBS 2019	CDC, YRBS, 2019
9	Youth electronic vapor product use (<i>Percentage of high school students who self-reported using an electronic vapor product within the 30 days before the survey.</i>)	TDOE, Office of Coordinated School Health, Youth Wellness Survey, 2019 / YRBS 2019	CDC, YRBS, 2019

Physical Activity			
10*	Physically active adults (<i>Percentage of adults who reported participating in physical activity such as running, calisthenics, golf, gardening, or walking for exercise over the past month.</i>)	Tennessee BRFSS. TDH, Office of Population Health Surveillance, 2019	Arundel Metrics analysis of CDC, BRFSS, 2019
11*	Physically active students (<i>Percentage of high school students who were physically active 60+ minutes per day for 5 or more days in last 7 days.</i>)	TDOE, Office of Coordinated School Health, Youth Wellness Survey, 2019 / YRBS 2019	CDC, YRBS, 2019
Obesity			
12	Obesity (<i>Percentage of adults with a body mass index of 30.0 or higher based on reported height and weight.</i>)	Tennessee BRFSS. TDH, Office of Population Health Surveillance, 2019	CDC, BRFSS, 2019
13	Obesity in higher density counties (<i>TN COPA Value: Percentage of adults in Hamblen, Sullivan, and Washington counties with a body mass index of 30.0 or higher based on reported height and weight; TN & US Values: Not stratified by population density.</i>)	Tennessee BRFSS. TDH, Office of Population Health Surveillance, 2019	n/a
14	Obesity in lower density counties (<i>TN COPA Value: Percentage of adults in Carter, Cocke, Greene, Hancock, Hawkins, Johnson, and Unicoi counties with a body mass index of 30.0 or higher based on reported height and weight; TN & US Values: Not stratified by population density.</i>)	Tennessee BRFSS. TDH, Office of Population Health Surveillance, 2019	n/a
15	Obesity among those with less than a high school education (<i>Percentage of adults with less than a high school education with a body mass index of 30.0 or higher based on reported height and weight.</i>)	Tennessee BRFSS. TDH, Office of Population Health Surveillance, 2019	CDC, BRFSS, 2019
16	Obesity among those with a high school education or more (<i>Percentage of adults with a high school education or more with a body mass index of 30.0 or higher based on reported height and weight.</i>)	Tennessee BRFSS. TDH, Office of Population Health Surveillance, 2019	n/a
17*	Obesity counseling and education (<i>Percentage of physician office visits that include counseling or education related to weight and physical activity.</i>)	(Data collection to be led by Ballard Health)	n/a
18*	Overweight and obesity among TN public school students (<i>Percentage of public school students in grades kindergarten, 2, 4, 6, 8, and one year of high school found to be overweight or obese during the school year.</i>)	TDOE, Office of Coordinated School Health, September, 2019	n/a

Breastfeeding Measures

19*	Average mPINC score (<i>Maternity Practices in Infant and Nutrition Care survey score based on seven birth facility policies and practices with higher scores denoting better maternity care practices and policies.</i>)	CDC Survey of Maternal Practices in Infant & Nutrition & Care (mPINC), 2018	CDC Survey of Maternal Practices in Infant & Nutrition & Care (mPINC), 2018
20*	Breastfeeding Initiation (<i>TN COPA, Peer, and TN Values: Percentage of live births whose birth certificates report that baby is breastfed. US Value: Proportion of infants who are ever breastfed.</i>)	TDH, Division of Vital Records and Statistics, Office of Vital Statistics, Birth Statistical Data System, 2019	CDC, National Immunization Survey, among 2017 births
21*	Infants breastfed at six (6) months (<i>Percentage of infants aged six (6) months whose guardians report at well-child visits they continue to be breastfed.</i>)	(Data collection to be led by Ballad Health)	CDC, National Immunization Survey, among 2017 births

High School Student Healthy Eating

22	Fruit consumption among high school students - (<i>Percentage of high school students who reported eating fruit during the past 7 days.</i>) Note: Pre-2017 data include drinking 100% fruit juice	TDOE, Office of Coordinated School Health, Youth Wellness Survey, 2019 / YRBS, 2019	CDC, YRBS, 2019
23	Vegetable consumption among high school students - (<i>Percentage of high school students who reported eating vegetables during the past 7 days.</i>)	TDOE, Office of Coordinated School Health, Youth Wellness Survey, 2019 / YRBS, 2019	CDC, YRBS, 2019
24	Soda consumption among high school students - (<i>Percentage of high school students who reported drinking soda or pop during the past 7 days.</i>)	TDOE, Office of Coordinated School Health, Youth Wellness Survey, 2019 / YRBS, 2019	CDC, YRBS, 2019

Substance Abuse

25*	NAS (Neonatal Abstinence Syndrome) Births (<i>Number of reported cases with clinical signs of withdrawal per 1,000 live births.</i>)	TDH, Neonatal Abstinence Syndrome Surveillance, 2019	n/a
26*	Drug deaths (<i>All drug overdose deaths caused by acute poisonings, regardless of intent per 100,000 population.</i>)	TDH, Division of Vital Records and Statistics, Office of Vital Statistics, Death Statistical Data System, 2019	CDC WONDER, 2018
27	Drug overdoses (<i>Non-fatal overdoses caused by acute poisonings, regardless of intent per 100,000 population.</i>)	TDH, Division of Population Health Assessment, Office of Health Statistics, Hospital Discharge Data System, 2018	n/a
28	Painkiller prescriptions (<i>Number of opioid prescriptions for pain per 1,000 population</i>)	TDH, Office of Informatics and Analytics, Controlled Substance Monitoring Database, 2019	CDC Annual Surveillance Report of Drug-Related Risks and Outcomes, 2019
29	Prescription drugs among high school students (<i>Percent of high school students who report ever taking prescription drugs without a doctor's prescription (such as codeine, Vicodin, OxyContin, Hydrocodone, and Percocet one or more times during their life.)</i>)	TDOE, Office of Coordinated School Health, Youth Wellness Survey, 2019 / YRBS 2019	CDC, YRBS, 2019

30*	MME for Pain (Total morphine milligram equivalents (MME) opioids for pain per capita)	TDH, Office of Informatics and Analytics, Controlled Substance Monitoring Database, 2019	CDC Annual Surveillance Report of Drug-Related Risks and Outcomes, 2019
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IMMUNIZATIONS

31*	On-time vaccinations – children (<i>Percentage of children that are up to date on state-required vaccines at the time of kindergarten entry.</i>)	Kindergarten Immunization Compliance Assessment, 2019	n/a
32*	Ballad entity participation in TennIIS (<i>Percentage of Ballad Health entities in Tennessee participating in TennIIS.</i>)	Ballad Health / Tennessee Immunization Information System (TennIIS), 2019	n/a
33	Entity participation in TennIIS (<i>Number of entities in Tennessee participating in TennIIS.</i>)	TennIIS, 2019	n/a
34	Vaccinations - HPV females (<i>Number of human papillomavirus (HPV) vaccine shots administered to females aged 11 to 17 years, either quadrivalent or bivalent.</i>)	TennIIS, 2019	n/a
35	Vaccinations - HPV males (<i>Number of human papillomavirus (HPV) vaccine shots administered to males aged 11 to 17 years, either quadrivalent or bivalent.</i>)	TennIIS, 2019	n/a
36*	Vaccinations - Tdap (<i>Number of tetanus-diphtheria-acellular pertussis (Tdap) vaccine shots administered to males aged 11 to 17 years.</i>)	TennIIS, 2019	n/a
37*	Vaccination Rate - Flu, Older Adults (<i>Percent of Medicare fee-for-service beneficiaries aged 65 and over with a flu vaccine claim.</i>)	Tennessee BRFSS. TDH, Office of Population Health Surveillance, 2019	CDC, BRFSS, 2019
38	Vaccinations - Flu, Adults (<i>Percent of adults aged 18 and over who self-reported receiving a flu shot or flu vaccine sprayed in nose in the past 12 months.</i>)	Tennessee BRFSS. TDH, Office of Population Health Surveillance, 2019	CDC, BRFSS, 2019

COMMUNITY / ENVIRONMENT

39*	Teen births (<i>Rate of births per 1,000 females aged 15-19 years.</i>)	TDH, Division of Vital Records and Statistics, Office of Vital Statistics, Birth Statistical Data System, 2019	CDC Wonder, 2018 data
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Third Grade Reading

40*	Third grade reading level (<i>Percentage of 3rd graders scoring "on-track" or "mastered" on TNReady reading assessment.</i>)	TDOE, 2019	n/a
41	Third grade reading level - Higher density counties (<i>TN COPA Value: Percentage of 3rd graders in Hamblen, Sullivan, and Washington counties scoring "on-track" or "mastered" on TNReady reading assessment; TN & US Values: Not stratified by population density</i>)	TDOE, 2019	n/a

42	Third grade reading level - Lower density counties (<i>TN COPA Value: Percentage of 3rd graders in Carter, Cocke, Greene, Hancock, Hawkins, Johnson, and Unicoi counties scoring "on-track" or "mastered" on TNReady reading assessment; TN & US Values: Not stratified by population density.</i>)	TDOE, 2019	n/a
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Oral Health

43	Fluoridated water (<i>Percent of population on community water systems receiving fluoridated water.</i>)	CDC, My Water's Fluoride, 2019	CDC Water Fluoridation Reporting System, 2018
44*	Children receiving dental sealants (<i>Percentage of Medicaid enrollees aged 6-9 years receiving dental sealants on permanent first molar teeth.</i>)	TennCare/DentaQuest, 2018-2019	n/a
45*	Adolescents receiving dental sealants (<i>Percentage of Medicaid enrollees aged 13-15 years receiving dental sealants on their first and second molar teeth.</i>)	TennCare/DentaQuest, 2018-2019	n/a

OUTCOMES

46	Frequent mental distress (<i>Percentage of adults who reported their mental health was not good 14 or more days in the past 30 days.</i>)	Tennessee BRFSS. TDH, Office of Population Health Surveillance, 2019.	CDC, BRFSS 2019
47	Frequent physical distress (<i>Percentage of adults who reported their physical health was not good 14 or more days in the past 30 days.</i>)	Tennessee BRFSS. TDH, Office of Population Health Surveillance, 2019	CDC, BRFSS 2019
48*	Infant mortality (<i>Number of infant deaths (before age 1) per 1,000 live births.</i>)	TDH, Division of Vital Records and Statistics, Office of Vital Statistics, Death Statistical Data System, 2019	CDC WONDER, 2018
49*	Low birthweight (<i>Percentage of infants weighing less than 2,500 grams (5 pounds, 8 ounces) at birth.</i>)	TDH, Division of Vital Records and Statistics, Office of Vital Statistics, Birth Statistical Data System, 2019	CDC WONDER, 2018
50	Child mortality (<i>Number of deaths per 100,000 children aged 1 to 18 years.</i>)	TDH, Division of Vital Records and Statistics, Office of Vital Statistics, Death Statistical Data System, 2019	CDC WONDER, 2018
51	Cardiovascular deaths (<i>Number of deaths due to diseases of the heart per 100,000 population.</i>)	TDH, Division of Vital Records and Statistics, Office of Vital Statistics, Death Statistical Data System, 2019	CDC WONDER, 2018
52	Cancer deaths (<i>Number of deaths due to all causes of cancer per 100,000 population.</i>)	TDH, Division of Vital Records and Statistics, Office of Vital Statistics, Death Statistical Data System, 2019	CDC WONDER, 2018
53	Diabetes deaths (<i>Number of deaths due to diabetes per 100,000 population.</i>)	TDH, Division of Vital Records and Statistics, Office of Vital Statistics, Death Statistical Data System, 2019	CDC WONDER, 2018
54*	Diabetes adverse events (<i>Percentage of adults identified with prediabetes who are referred to a qualifying diabetes prevention program.</i>)	(Data collection to be led by Ballad Health)	n/a

55	Suicide deaths (<i>Number of deaths due to intentional self-harm per 100,000 population.</i>)	TDH, Division of Vital Records and Statistics, Office of Vital Statistics, Death Statistical Data System, 2019	CDC WONDER, 2018
56*	Premature death ratio (<i>Ratio of years lost before age 75 per 100,000 population for higher density counties to lower density counties.</i>)	TDH, Division of Vital Records and Statistics, Office of Vital Statistics, Death Statistical Data System, 2019	n/a

* These measures are the Priority Population Health Measures. The Population Health Sub-Index score will be calculated based on the changes tracked on these 25 measures.

n/a – Data will not be compared at this level.

Appendix 4:

Population Health 'Peer Counties' Methodology Notes

Selection of TN Peer Counties

For each metric, comparison geographies are established to permit a comparison of the health in the TN COPA Region to the Peer Counties, the state of Tennessee and the United States. For Population Health Sub-Index evaluation purposes, Peer Counties are established the beginning of the project and held constant.

The following process was used to establish the peer reference group, with the TN COPA counties considered as a single community.

- a. Select counties based upon five primary factors⁷
 - i. Income/Poverty
 1. Income is represented by the median household income.
 2. Poverty is represented equally by the estimated percentage of the population whose income is below the poverty level in two vulnerable groups, those younger than age 18 and those aged 65 and older.
 - ii. Age distribution
 1. Age distribution is represented equally by the percentage of the population younger than age 18 and the percentage aged 65 and older.
 - iii. Educational attainment
 1. Education is represented equally by the percentage of adults aged 25 and older without a high school diploma and the percentage of adults aged 25 and older with a bachelor's degree.
 - iv. Population density
 1. Population is represented equally by the population density (population/square mile) and percent rurality.
 - v. Geographic proximity to TN GSA - 570 Bowmantown Rd, Telford, TN 37690 was used as the center of the TN GSA, approximately 55 air miles from three corners of TN GSA.

⁷ The selection of categories is based upon the model used for establishing peer counties for Community Health Status Indicator project, <https://wwwn.cdc.gov/CommunityHealth/info/HowtoUseReport>. Measures were selected based upon availability and appropriateness to the GSA.

- b. All data except for distance are standardized using the average of the sample data points and the standard deviation of the sample data points. All z-scores are limited to +/-2 standard deviations from the mean to eliminate outliers.
 - i. To normalize the geographic proximity to the TN GSA, the standard deviation of the distance between each county and the center of the TN GSA is approximated by the standard deviation of each state (Hawaii and Alaska are excluded) from center of the TN GSA.
- c. Calculate the difference of each metric from the TN GSA.
 - i. The value for each metric for the TN GSA is the population weighted prevalence for the ten counties in the TN GSA.
 - ii. The difference is the mathematical difference between the normalized value for the TN GSA and the normalized value for each county included in the analysis.
- d. Select the counties by minimizing the square root of the sum of the square of the normalized distances each of the metrics are from the TN GSA.
 - i. All five primary factors have equal weight. For Income/Poverty, income is weighted equally with overall poverty. Overall poverty is the equal weighting of the two categories of poverty: under 18 and age 65+. For all other primary factors, the two metrics are weighted equally.
- e. Continue selecting counties until the total population of the selected counties is at least equal to the total population in the TN COPA Region AND there are at least ten counties.

TN COPA Region - Population Density Stratification

To allow for stratification of the TN GSA by population density, the TN GSA was divided into a higher density region (TN COPA Region-Higher density) and a lower density region (TN COPA Region - Lower density). The higher density counties consist of the three most densely populated TN COPA counties: Hamblen, Sullivan and Washington. The lower density counties are the remaining seven counties in the TN COPA Region: Carter, Cocke, Green, Hancock, Hawkins, Johnson and Unicoi.

Some demographic differences between the TN COPA higher density and lower density regions are below:

Characteristic	TN COPA Region - Higher density	TN COPA Region - Lower density
Population per square mile, 2010	375-390	<170

Median HH income	\$37,617-\$42,817	\$26,898-\$36,927
Average median HH income of counties within group	\$40,260	\$32,485
Median age	44.2 years	43.1 years
Percent with college degree	15.5% - 30.6%	9.2% - 12.6%
Percent in poverty	16.4% - 19.0%	18.0% - 31.0%
YPLL-75 ⁸ (years lost before age 75 per 100,000)	9,124	10,726

TN Peer Counties - Population Density Stratification

Method 1: Considering all Tennessee counties

If all Tennessee counties except those within the service area were considered possible peer counties, the following would be considered peer counties⁹.

Lower Population Density Peer Counties	Higher Population Density Peer Counties
Claiborne Granger Monroe Campbell Meigs McMinn Roane	Anderson Sevier Jefferson Blount

The parameters for determining Tennessee Peer Counties were child poverty, elder poverty, less than high school diploma, college graduate, household income and distance to service area; identical to those used to select overall peer counties except that population density and rurality were removed. In addition, a population density of 150 persons/square mile was used to stratify counties into higher and lower density groups. The number of counties was selected such that the total population in the peer counties was roughly equal to the population in the service area counties.

⁸ Population-weighted YPLL-75, based upon County Health Rankings, 2016, accessed Sept, 2016

⁹ Counties are listed in order of “fit” with service area counties, that is those on the top of the list are most similar to the service area counties.

Method 2: Considering only Service Area counties

For this analysis, only peer counties identified in the COPA (Anderson, Cannon, Claiborne, Cumberland, Jefferson, McMinn, Marion, Monroe, Putnam, Roane, Sevier and White) were used as options for the peer county comparison set.

The peer counties were sorted by population density from Cannon (52 persons per square mile) to Anderson (225 persons per square mile). The most population-dense counties were then selected as the comparison set for the higher population density counties in the service area and the lower ones to compare to the lower population density counties in the service area.

County	Population Density (#/Sq. Mi.)
Cannon	52
Marion	57
White	70
Monroe	72
Claiborne	73
Cumberland	86
McMinn	122
Roane	146
Sevier	162
Putnam	186
Jefferson	194
Anderson	224

These 12 counties were then modeled using poverty, age distribution, education, and distance to see which are closest in terms of being peer counties. The result was a different ordering of the counties than listed above, but one that supported using the denser counties as comparison for the higher density columns in the service area. The listing by population density is much simpler. The modeling suggests the cutoff should be 150 persons per square mile, making Sevier, Putnam, Jefferson, and Anderson counties as the comparison group for the more densely populated counties within the service area.

Yet, the initial modeling indicates that these counties, even with lower population densities, closely resemble the higher population density counties in the service area. Therefore, the decision was made that the comparison group for higher-density counties in the service area consist of Sevier, Putnam, Jefferson, and Anderson. All other counties from the original peer county list are considered the peer group for lower population density counties.

Appendix 5:

Population Health Sub-Index Data Notes

Notes: Tennessee and US values for the following measures were based on America's Health Rankings analysis of CDC's WONDER Online Database, Water Fluoridation Reporting System and Behavioral Risk Factor Surveillance System, United Health Foundation, AmericasHealthRankings.org, Accessed 2021:

- Teen Births (measure #39) - accessed via https://www.americashealthrankings.org/explore/annual/measure/TeenBirth_MCH/TN/ALL
- Fluoridated Water (measure #43) - accessed via http://www.americashealthrankings.org/explore/annual/measure/water_fluoridation/TN/ALL
- Frequent Mental Distress (measure #46) - accessed via https://www.americashealthrankings.org/explore/annual/measure/mental_distress/TN/ALL
- Frequent Physical Distress (measure #47) - accessed via https://www.americashealthrankings.org/explore/annual/measure/Physical_distress/TN/ALL
- Low Birthweight Babies (measure #49) - accessed via <https://www.americashealthrankings.org/explore/annual/measure/birthweight/state/ALL>

DentaQuest data:

- Dental sealant 2018-2019 data were collected from 10/1/2018 - 9/30/2019.

Behavioral Risk Factor Surveillance System data:

- All estimates are weighted using demographic information from each of the four geographies: 1) The TN COPA Region; 2) TN Peer Counties region; 3) the state of Tennessee; and 4) the US.
- Prevalence estimates with a numerator or denominator less than 50 were suppressed.
- Sampling frame deviations and anomalies in the BRFSS 2019 US data are detailed in a CDC BRFSS report that can be accessed here: https://www.cdc.gov/brfss/annual_data/2019/pdf/compare-2019-508.pdf.

Tennessee Immunization Information System data:

- A participating facility is an entity in TennIIS production that has submitted or entered an administered and/or historical vaccination during the year of evaluation.

- Vaccinations are evaluated as being administered by the entities in each county group (the TN COPA Region, TN Peer Counties region, and the state of Tennessee) during the year of evaluation.
- The entity can report administered and/or historical vaccinations and the entity can submit these vaccines manually or electronically. The number of participating entities were summed for: 1) Ballard, 2) the TN COPA Region, 3) TN Peer Counties region, and 4) the state of Tennessee.
- Vaccination CVX codes identified were pulled for each county group; these may not include all CVX codes associated with those vaccination families as some CVX codes are not relevant.
- Population data source: 2019 Population Data Files, Division of Population Health Assessment, Tennessee Department of Health.

IMMUNIZATION	VACCINATION CVX CODES EVALUATED
HPV	HPV, quadrivalent - CVX CODE 62; HPV, bivalent - CVX CODE 118; Human Papillomavirus 9-valent vaccine - CVX CODE 165; HPV, uncertain formulation - CVX CODE 137
TDAP	Tdap - CVX CODE 115

Vital Statistics data:

For Death Statistical Data System: Crude rates were used for the TN COPA Region, TN Peer Counties region, and the state of Tennessee. Crude rates were also used for US estimates and were not age adjusted.

ICD-10 Coding for Tennessee Mortality Data, 2019

Underlying Cause of Death	ICD-10 Codes or UCD Group Codes Used
Diseases of the Heart	UCD Group Codes 049-059
Cancer	UCD Group Codes 018-040
Diabetes	UCD Group Code 043
Suicide	UCD Group Codes 105 and 106
All Drug Overdoses	ICD-10 codes for underlying cause of death: X40-X44, X60-X64, X85, Y10-Y14

Youth Wellness Survey data:

- The Youth Wellness Survey is an online survey on health behaviors administered annually in Tennessee's public high schools.
 - The Youth Wellness Survey consists of a limited number of Youth Risk Behavior Survey questions and follows the same sampling methodology used for the YRBS.
 - Schools are selected with probability proportional to the size of student enrollment in grades 9-12 and then a specific period of the school day (e.g., 2nd period) is randomly selected to participate. Within selected classes, all students are eligible to participate.
 - Tennessee COPA and Peer subsets were weighted by grade to match the US population proportions for high school students.
 - Only respondents with a valid grade level (9, 10, 11 or 12) were used in the analysis.
 - Participation level:
 - COPA: 10/10 counties = 100%; 1047/1462[†] students = 71.6%; Participation = 71.6%
 - Peer: 12/12 counties = 100%; 1177/1462[†] students = 80.5 percent; Participation = 80.5%
- † = 1,462 is the projected sample size for both regions based on school enrollments.

NOTE: The definition for Youth Tobacco Use (measure # 7) changed as of the Department's 2019 Population Health report. Due to the reduced number of questions on the youth wellness survey, this measure now only tracks current cigarette smoking instead of current use of multiple tobacco products.

The CDC Annual Surveillance Report of Drug-Related Risks and Outcomes:

- Values for the following two measures were from a 2019 report that used 2018 data: Painkiller Prescriptions (measure # 28) and MME for Pain (measure # 30).

Mothers who smoke during pregnancy. US value:

- The US value is based on births occurring within the United States to US residents.
- Each birth record represents one living baby.
- For more information, visit: <https://wonder.cdc.gov/wonder/help/Natality.html#TobaccoUse>.

Overweight and obesity prevalence among students, Tennessee values:

Body Mass Index (BMI) is calculated based on the height and weight measurements collected during screening in the current school year. BMI measurements are age and sex specific for children and teens. Some counties and school districts require an active opt-in informed consent

for BMI student data collection. This requirement can have a significant impact on the number of students screened.

Overweight/obese was defined as body mass index greater than or equal to the 85th percentile for children of the same age and sex. Data were collected by the Tennessee Department of Education's Office of Coordinated School Health in partnership with TDH.

Breastfeeding initiation, US value:

- Breastfeeding rates are based on the National Immunization Survey's dual-frame sample that includes respondents surveyed on landline or cellular telephones. Additional information about the sampling methodology and the impact of adding a sample of cellular telephone respondents to the National Immunization Survey, is available at: https://www.cdc.gov/breastfeeding/data/nis_data/survey_methods.htm. Data sources and methodology used for the US value differ slightly from those used for the TN and sub-state values but the data are still useful for the purpose of comparing trends.
 - The CDC NIS value is an estimate is the proportion of infants born in 2017 whose parents answered on a phone survey that their babies had been breastfed or fed breast milk.
 - The TN vital statistic data come from Tennessee birth certificates, which asks if the newborn is breastfeeding.

US Breastfeeding initiation data acknowledgment: CDC National Immunization Survey (NIS) for births in 2017. Accessed December 2, 2020 at <https://www.cdc.gov/breastfeeding/data/reportcard.htm> and https://www.cdc.gov/breastfeeding/data/nis_dat/results.html

Neonatal Abstinence Syndrome, Tennessee values:

Neonatal Abstinence Syndrome (NAS) Data acknowledgment: Neonatal Abstinence Syndrome Surveillance System, Division of Family Health and Wellness; Tennessee Department of Health. Birth Statistical System, Division of Vital Records; Tennessee Department of Health.

Non-Fatal Drug Overdose, Tennessee values:

- All drug overdose *inpatient* hospitalizations of Tennessee residents caused by non-fatal acute poisonings due to the effects of drugs, regardless of intent.
- All drug overdose *outpatient* visits by Tennessee residents caused by non-fatal acute poisonings due to the effects of drugs, regardless of intent.

- Count/rate suppressed in accordance with TDH Data Suppression Guidelines.

Additional Notes, inclusions, and exclusion:

- Counties determined by numeric county of residence code in HDDS data (tn_co_res).
- Rates are calculated using the county population for a given year per 100,000 residents. [i.e., (count/population)*100000] For county populations by year. Population data is obtained from CDC Wonder bridged race populations estimates. The vintage year of the populations corresponds to the year of the indicator. (see <http://wonder.cdc.gov/bridged-race-population.html> for more details)
- Primary Inclusion/Exclusion Criteria: Only Tennessee Residents; Excludes patients discharged as dead/deceased; Limited to non-federal acute care-affiliated facilities. Excludes VA and other federal hospitals, rehabilitation centers, and psychiatric hospitals.
- Outpatient Visit Inclusion Criteria: Flagged as an outpatient record by THA.
- Inpatient Hospitalization Inclusion Criteria: Flagged as an inpatient record by THA.
- All Drug Overdose Inclusion Criteria: First 3 characters of Principal Diagnosis ICD-10 code falls in the range T36-T50 (Poisoning by drugs, medicaments, and biological substances); AND the intent is accidental/unintentional, intentional self-harm, assault, or undetermined intent (not adverse effects or underdosing) ; AND it is the initial or a subsequent encounter (not sequela).

Morphine milligram equivalents opioids for pain per capita, Tennessee values:

Morphine milligram equivalents or MME are calculated as the quantity multiplied by the strength of the drug per unit multiplied by a conversion factor provided to the Tennessee Department of Health by the CDC.

Additional notes and exclusions:

- Only Tennessee residents were considered;
- Only drug schedules II, III and IV were included;
- Only drugs identified in the CDC's 2017 MME Conversion Table were considered;
- Only opioid prescriptions FDA label indicated for pain (analgesics) contribute to the MME calculation;
- Prescriptions with zero or implausibly high quantities were excluded; and
- Prescriptions with zero or implausibly high days' supply were excluded.

Third Grade Reading Level, Tennessee values

- Reflects proficiency TNReady ELA, English I, English II and English III.
- Results are suppressed where the number of valid test scores is less than ten. In these files, suppression also occurs where any individual proficiency level is less than one percent or greater than 99 percent at the state and district level, or less than five percent or greater than 95 percent at the school level.
- As of 2016-2017 school year, the definition of Third Grade Reading Level changed to “Third graders scoring ‘mastered’ or ‘on-track’ on TNReady reading assessment”.¹⁰

***All data are subject to limitations as explained in the data source.*

¹⁰ To read more, visit <https://www.tn.gov/content/tn/education/assessment/tntready.html>

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